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IS 11452 (1985): Method of testing air-setting refractory mortars [MTD 15: Refractories]



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IS : 11452 - 1985

Indian Standard

METHOD OF TESTING AIR-SETTING
REFRACTORY MORTARS

UDC 666.767 : 620.1



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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Indian Standard

METHOD OF TESTING AIR-SETTING REFRACTORY MORTARS

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Indian Standard

METHOD OF TESTING AIR-SETTING REFRACTORY MORTARS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 24 September 1985, after the draft finalized by the Refractories Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard has been formulated for rationalizing the test methods used for assessment of the quality of air-setting refractory mortars and for checking their conformity to the quality specifications.

0.3 In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard covers methods of test of all types of air-setting refractory mortars available in any premixed type dry, wet or as two components (powder and liquid binder supplied separately).

2. TERMINOLOGY

2.1 Refractory Mortar — Refractory material containing chemical agents that ensures hardening at room temperature.

2.1.1 Mortar produced in the two components systems shall have such quality and workability that it can be spread satisfactorily with a trowel when mixed with requisite quantity of the recommended mixing liquid component.

3. SAMPLING

3.1 In any consignment of the container/bags holding refractory mortars of the same type and grade, manufactured by the same firm under similar conditions of productions shall be grouped together to constitute a lot. The maximum size of any lot, however, shall be limited to 25 tonnes.

*Rules for rounding off numerical values (revised).

3.2 For every consignment of 100 containers/bags or a part thereof, the contents of five containers/ bags selected at random shall be removed and mixed thoroughly. The final sample of 5 kg shall be obtained by mixing thoroughly and coning and quartering and then sealed in a clean metal or glass container. For two component mortar systems, liquid binder should also be collected to represent the requisite quantity as per the ratio recommended and sealed.

3.3 When the consignment is more than the quantity mentioned in 3.2 the quantity to be collected, as sample, shall be as follows:

<i>No. of Drymix or Wetmix Containers/Bags</i>	<i>No. of Drymix or Wetmix Containers/Bags to be Selected as Samples</i>
Up to 100	5
above 100 up to 300	10
above 300 up to 500	15

4. TEST REQUIREMENTS

4.1 The following parameters are tested for the purpose of evaluating the air-setting mortar as agreed to between the manufacturer and the purchaser:

- a) Sieve analysis,
- b) Chemical analysis,
- c) Bond strength,
- d) Refractoriness, and
- e) Drying and firing shrinkage.

4.2 For testing all parameters for two component mortar systems, the test sample should be prepared by mixing thoroughly the powder component and the recommended proportionate quantity of liquid before taking up the testing except sieve analysis. In the case of a single component premixed mortars the sample may be taken directly.

5. SIEVE ANALYSIS

5.1 The sieve analysis shall be conducted in accordance with IS : 1528 (Part 14)-1974* on the dry powder component in the case of two component mortar and on ready mixed material in case of a single component material, immediately after sampling so that setting does not take place.

*Methods of sampling and physical test for refractory materials: Part 14 Sieve analysis (first revision).

6. CHEMICAL ANALYSIS

6.1 The chemical analysis shall be carried out in accordance with IS : 1527-1972*.

7. BOND STRENGTH

7.1 Principle — This method of test covers a procedure for determining the bond strength of all types of air-setting refractory mortars by conducting the modulus of rupture test of oven dried bricks joined with the test mortar.

7.2 Apparatus — The following apparatus will be used:

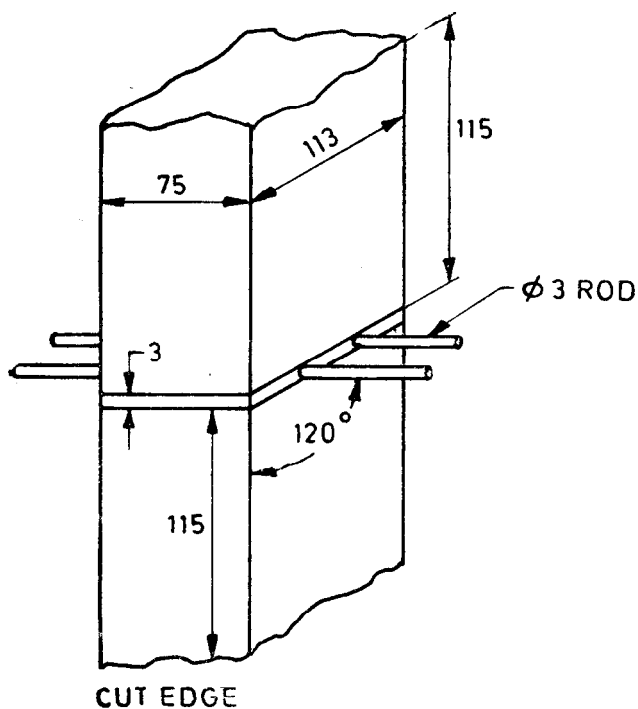
- a) Two spacing rods of 3 mm dia each,
- b) Drying oven, and
- c) Compression testing machine with modulus of rupture rig.

7.3 Sampling — Representative samples shall be drawn from the containers or bags. The contents shall be thoroughly mixed in the container or transferred without loss to a clean impervious receptacle of larger size and mixed thoroughly to a uniform consistency. In the case of two component mortar systems requisite quantity of liquid shall be added and mixed thoroughly as above.

7.4 Procedure — Select 5 standard bricks of size $230 \times 113 \times 75$ mm having a modulus of rupture value higher than that anticipated in the mortar. Cut each of the five bricks into two equal parts on a plane parallel to the 75×113 mm face. Use the uncut 75×113 mm face of each half brick to form the mortar joint. Apply the mortar to the uncut face to 5-6 mm thickness and squeeze to form a joint of 3 mm in thickness of the uncut and horizontally placed face of one half brick. This is facilitated by placing two spacer-rods in the mortar parallel to the 75 mm edges of the brick (see Fig. 1). Place the uncut face of the other half brick on the mortar. Force out the excess mortar in the joint by pressing on the top half brick and at the same time moving it with a to and fro motion in the direction of 113 mm dimension of the brick using the spacer rods as rollers. Withdraw the rods and clean the excess mortar from the surface of the joint. Allow the joints to air dry undisturbed at room temperature for 24 hours and then oven dry at 110°C for at least 12 hours. Upon removal from the oven allow them to cool and test them for modulus of rupture (see Fig. 2 and 3). The modulus of rupture test should be conducted on a span of 180 mm as given in IS : 1528 (Part 5)-1974†. Report the individual values of the three determinations for the modulus of rupture of the mortar joint as the bond strength.

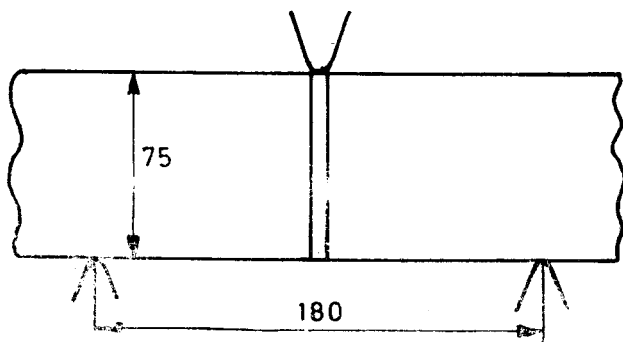
*Methods of chemical analysis of high silica refractory materials (first revision).

†Methods of sampling and physical tests for refractory materials: Part 5 Determination of modulus of rupture (first revision).



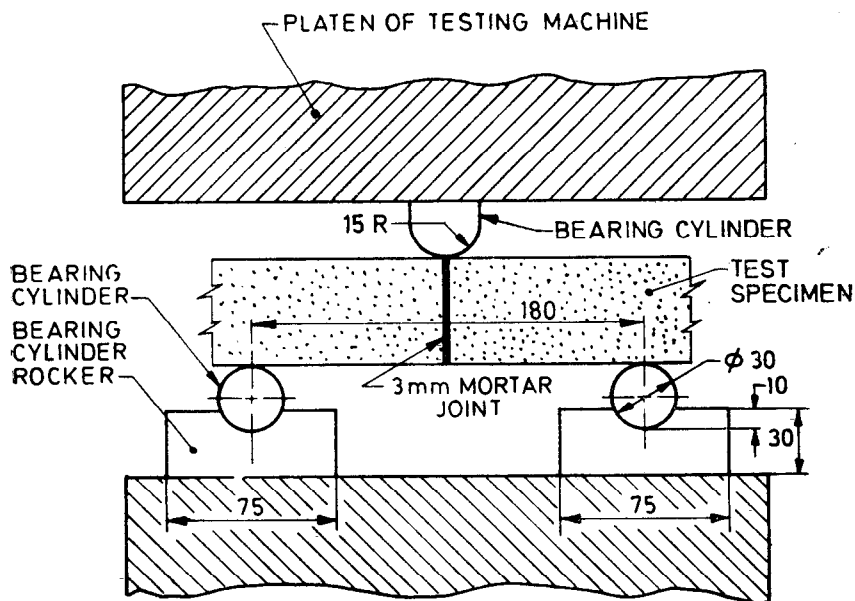
All dimensions in millimetres.

FIG. 1 PREPARATION OF TEST PIECE FOR MODULUS OF RUPTURE TEST



All dimensions in millimetres.

FIG. 2 ARRANGEMENT FOR MODULUS OF RUPTURE TEST



All dimensions in millimetres.

FIG. 3 ALTERNATE DESIGN OF BEARING EDGES FOR MODULUS OF RUPTURE TEST

8. REFRACTORINESS

8.1 Refractoriness shall be determined according to method laid down in IS : 1528 (Part 1)-1980†.

9. DRYING AND FIRING SHRINKAGE TEST

9.1 Apparatus

9.1.1 *Kiln* — The kiln used for the test shall be of such design as not to permit the flame to impinge directly from the burner upon the test specimen. The kiln atmosphere during the test shall be kept as oxidizing as is practicable. If it is not possible to use the kiln, an electric furnace may be used maintaining the conditions stated above for the kiln.

*Methods of sampling and physical test for refractory materials: Part 1 Determination of pyrometric cone equivalent (PCE) or softening point (*second revision*).

9.1.2 Thermocouples and Pyrometers — For temperatures up to 1450°C, a platinum/platinum rhodium thermocouple and pyrometer of the recording type shall be provided. For temperatures above 1450°C an optical pyrometer shall be used.

9.2 Preparation of Test Specimen — Three test specimens of the size 50 × 50 × 125 mm may be formed in metal moulds. The ready mix mortar or two-component mortar system shall be made to the working consistency and poured in the mould. This shall be allowed to set undisturbed at the room temperature for 24 hours. After the mortar has set (there being no further deformation), two marks 75 mm apart uniformly spaced from the centre of the specimen, shall be made with the help of vernier callipers on each specimen. The samples shall then be dried for 12 hours at 110°C. The distance between the two marked points shall be measured with the help of the vernier calipers and percentage drying shrinkage shall be calculated for each specimen. To ensure that the specimens have dried completely, these shall be again dried at 110°C for 12 hours and shrinkage measured again as per the procedure outlined above. The average of the 3 readings for the specimens shall be the percentage drying shrinkage.

9.3 Firing Shrinkage — After the drying shrinkage measurement, the specimens shall be fired up to the intended service temperatures in the test kiln (furnace). Location of the test specimens, temperature measurements, temperature schedule and cooling shall be in accordance with IS : 1528 (Part 6)-1974*. Percentage firing shrinkage shall then be determined for each specimen and the average of the 3 readings shall be the percentage firing shrinkage for the mortar.

9.3.1 Temperature and time duration of firing shall be as agreed to between the user and the manufacturer depending on the requirements of the user.

*Methods for sampling and physical tests for refractory materials: Part 6 Determination of permanent change after reheating (*first revision*).

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